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Memorandum

To	**Dr Paul Stangroom**	From	**Bill Dawson**
Copy		Reference	**236777**
Date	**9 July 2014**	Pages (including this page)	**7**
Subject	**Glen Innes Wind Farm – Response to Department of Planning and Environment**		

This memorandum provides the additional information requested by the Department of Planning and Environment (provided to Aurecon via email on 17 June 2014) and summarised as follows:

> "*A comparison table is required that details the worst case noise predictions for each receiver at a single wind speed (9m/s) as shown in the supplementary noise assessment of 2010 versus the worst case noise predictions as shown in the modification assessment, noting the differences between the 2 predictions (+/-ve).*
>
> *An indication is required as to the percentage of time the wind will likely be blowing from the west….and therefore percentage of time the sector management approach will be operated to ensure no noise exceedances occur.*"

On 9 July 2014, the Department of Planning and Environment requested that the comparison of predicted noise levels be undertaken for a hub height wind speed of only 10m/s as follows (email from Paul Stangroom, 'Re: Glen Innes – noise/traffic' on 9 July 2014):

- Comparison of the Vestas V90 – 3.0MW turbine and the Alstom ECO 122 – 2.7MW turbine predicted noise levels using the original ISO 9613-2 model inputs
- Comparison of the Vestas V90 – 3.0MW turbine and the Alstom ECO 122 – 2.7MW turbine predicted noise levels using the updated ISO 9613-2 model inputs as outlined in '*Prediction and assessment of wind turbine noise – Agreement about relevant factors for noise assessment from wind energy projects, Acoustic Bulletin March/April 2009, Institute of Acoustics 2009'*

1 Comparison Table of 2010 and 2013 Noise Assessments

Comparison of the noise predictions is based on the following reports and noise data:

- Supplementary Noise Assessment, Glen Innes Wind Farm Middletons. Report ref: 208846-001-01. 8 June 2010. Revision 3. Noise predictions based on the Vestas V90 – 3.0MW wind turbine.
- Glen Innes Wind Farm, Environmental noise assessment – Wind Turbine Modification. Reference: 236777. 26 November 2013. Revision 4. Noise predictions are based on the Alstom ECO 122 – 2.7MW wind turbine.

It is important to note that the 2010 and 2013 assessments have different wind turbine layouts, and therefore the predicted noise levels are not directly comparable.

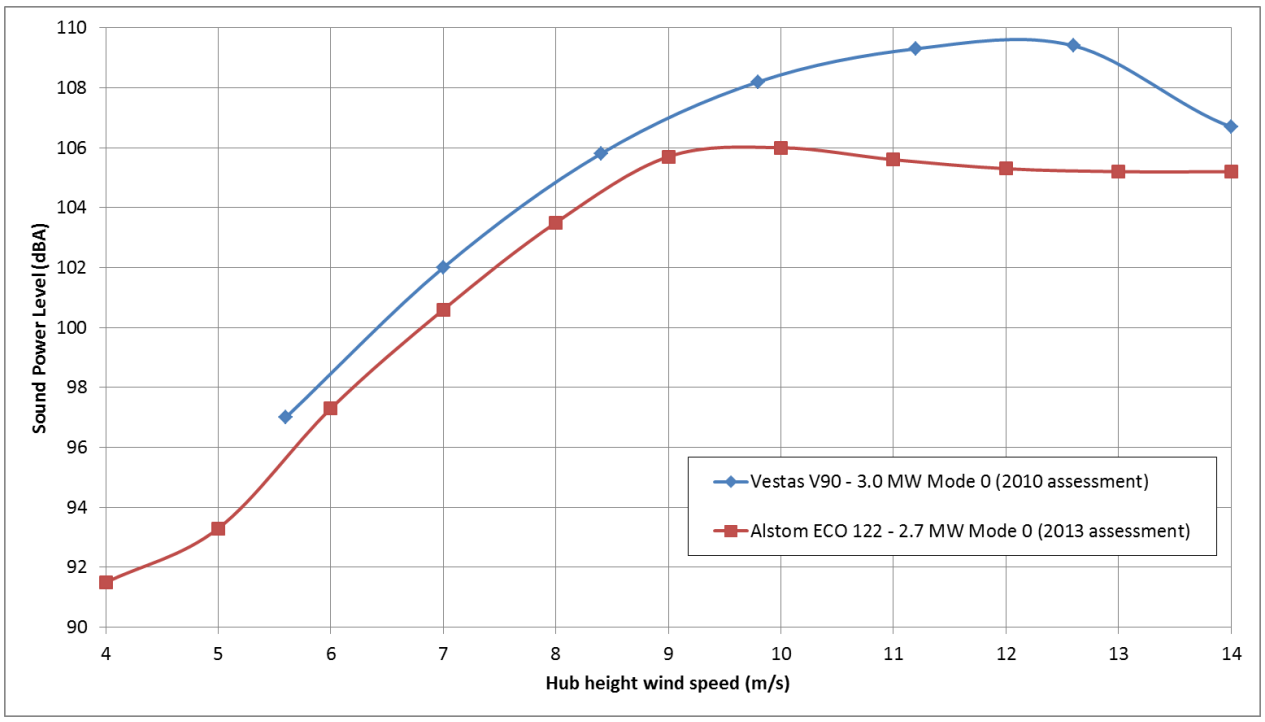

Figure 1: Comparison of the 2010 and 2013 wind turbine sound power levels

Comparison of the predicted noise levels at a hub height wind speed of 10m/s are presented in Table 1 using the original ISO 9613-2 model inputs. Table 2 presents comparison of the predicted noise levels at the same hub height wind speed of 10m/s using the updated ISO 9613-2 inputs, summarised as follows:

- Relative humidity – 70%
- Ambient temperature – 10°C
- Atmospheric pressure – 1 atm
- Ground absorption, G = 0.5
- Receivers at a height of 4 m above ground
- Barrier attenuation calculation within ISO 9613-2 not incorporated

Exceedances of the overall criteria are highlighted in yellow, where constrained operation modes of the wind turbines may be required to meet the criteria, depending upon final selection of the wind turbine generator.

Table 1: Comparison of the Vestas V90 – 3.0MW and the Alstom ECO 122 – 2.7MW noise predictions at a hub height wind speed of 10m/s using the original ISO 9613-2 model inputs. Exceedances of the overall criteria are highlighted in yellow.

Receiver	Vestas V90 – 3.0MW predicted noise levels, dB(A)		Alstom ECO 122 – 2.7MW predicted noise levels, dB(A) *	
	Non-limited mode operation	Constrained operation mode	Non-limited mode operation	Constrained operation mode
Balaclava A	30	30	23	-
Elm Vale	28	28	20	-
Cherry Tree / Eungai	35	34	28	-
Girrahween	31	31	25	-
Glengarry	29	28	23	-
Glengyle	37	36	32	-
Green House	30	30	23	-
Highfields	38	37	31	-
Hillside	41	40	37	-
Ilparran A	35	35	31	-
Ilparran B	36	36	31	-
Kalanga A	33	33	27	-
Kalanga B	32	32	26	-
Kalanga C	32	32	26	-
Klossie	29	29	22	-
Lombardy	33	32	26	-
Matheson Church	29	29	22	-
Mayvona	38	36	32	-
Minamurra A	32	32	26	-
Minamurra B	33	33	27	-
Minamurra C	32	32	25	-
Moonarie	29	27	19	-
Nullagai	29	29	23	-
Green Valley / Oakes	31	31	24	-
Rivoli	29	29	24	-
Rose Hill A	31	31	25	-
Rose Hill B	30	29	26	-
Wandsworth	32	32	24	-
Wattle Vale	30	30	24	-

** Note: Constrained operation mode for the Alstom ECO 122 – 2.7MW turbine was not modelled using the original (superseded) ISO 9613-2 model inputs.*

Table 2: Comparison of the Vestas V90 – 3.0MW and the Alstom ECO 122 – 2.7MW noise predictions at a hub height wind speed of 10m/s using the updated ISO 9613-2 model inputs. Exceedances of the overall criteria are highlighted in yellow.

Receiver	Vestas V90 – 3.0MW predicted noise levels, dB(A)		Alstom ECO 122 – 2.7MW predicted noise levels, dB(A)	
	Non-limited mode operation	Constrained operation mode	Non-limited mode operation	Constrained operation mode
Balaclava A	34	33	30	30
Elm Vale	32	25	26	24
Cherry Tree / Eungai	39	33	34	33
Girrahween	35	35	32	32
Glengarry	35	33	29	28
Glengyle	41	40	38	38
Green House	35	29	30	28
Highfields	42	36	37	36
Hillside	46	41	43	41
Ilparran A	40	37	37	36
Ilparran B	40	35	37	36
Kalanga A	37	35	33	33
Kalanga B	36	34	32	32
Kalanga C	36	34	33	33
Klossie	34	28	29	27
Lombardy	37	32	32	31
Matheson Church	32	32	28	28
Mayvona	43	37	38	35
Minamurra A	36	33	32	32
Minamurra B	37	34	33	33
Minamurra C	35	32	32	31
Moonarie	31	25	26	24
Nullagai	35	29	30	28
Green Valley / Oakes	34	29	30	30
Rivoli	34	34	31	31
Rose Hill A	36	35	32	32
Rose Hill B	37	36	32	32
Wandsworth	35	30	31	29
Wattle Vale	34	34	31	31

Discussion of noise prediction comparison tables as follows:

- The overall A-weighted sound power levels for the ECO 122 – 2.7MW wind turbine are lower than the Vestas V90 – 3.0MW wind turbine at all reported hub height wind speeds from 6m/s to 14m/s, as shown in Figure 1
- Comparison of the predicted ECO 122 – 2.7MW predicted noise levels shows that noise impact (at a hub height wind speed of 10m/s) in non-limited operation mode will be at least 3 dB(A) less than if the Vestas V90 – 3.0MW wind turbine was used. Note that this reduction is due to the combined impact of reduced sound power level and the revised turbine layout.
- Worst-case noise predictions for all of the assessed wind turbine models (Vestas V90 – 3.0MW and ECO 122 – 2.7MW) operating in non-limited operation will result in exceedances of the criteria at the Highfields and Mayvona receivers, and therefore constrained operation modes of the wind turbines will be required to meet the criteria during worst-case conditions (at the relevant wind speeds and directions, depending on final selection of the wind turbine model).

2 Likelihood of Westerly Wind

With regard to the Department of Planning and Environment request for an indication as to the percentage of time the wind will likely be blowing from the west (and therefore the percentage of time the sector management approach will be operated), we refer to Parsons Brinckerhoff '*Glen Innes Wind Farm Wind Resource and Energy Yield Assessment*' report for NP Power Pty Ltd dated 16 April 2011. Figures 2 through 5 present the relevant wind direction data for the nearest monitoring locations.

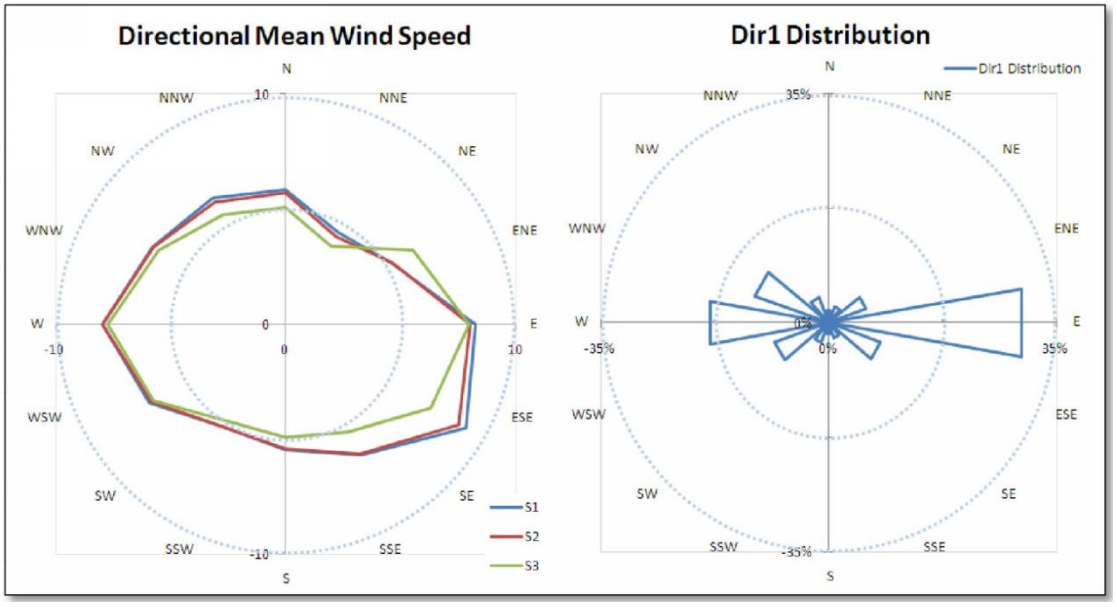

Figure 2: Glenroy wind direction distribution (2005 to 2010 monitoring)

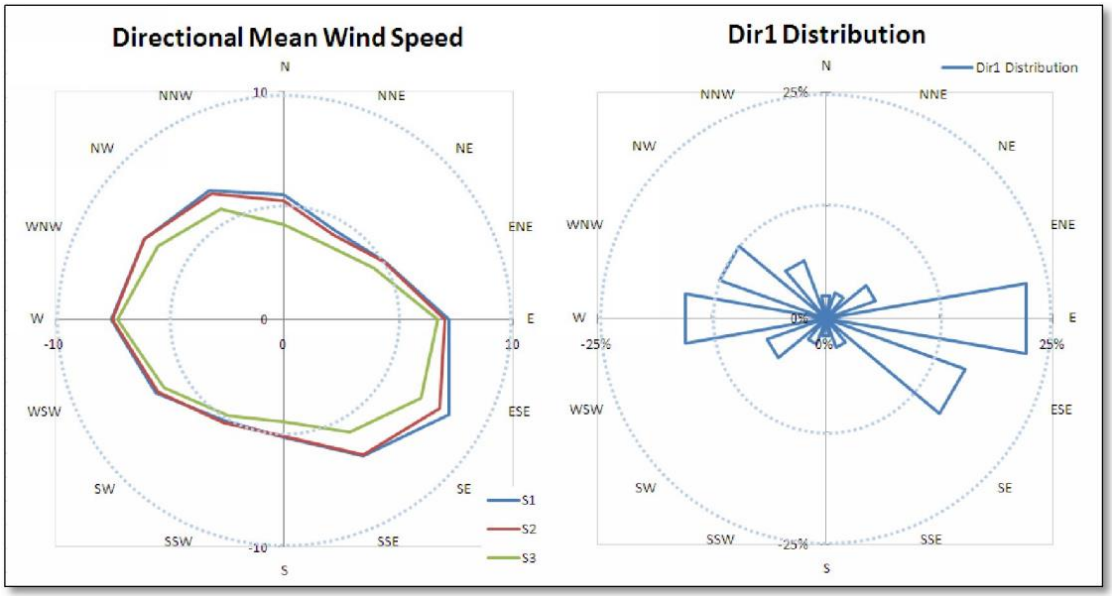

Figure 3: Nant Lodge wind direction distribution (2005 to 2010 monitoring)

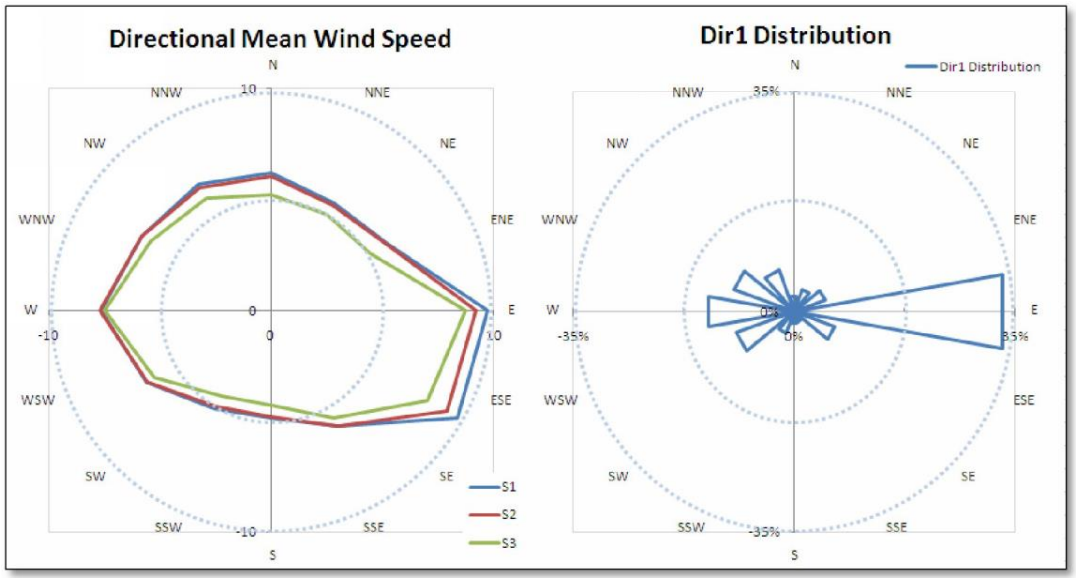

Figure 4: Rose Hill wind direction distribution (2005 to 2010 monitoring)

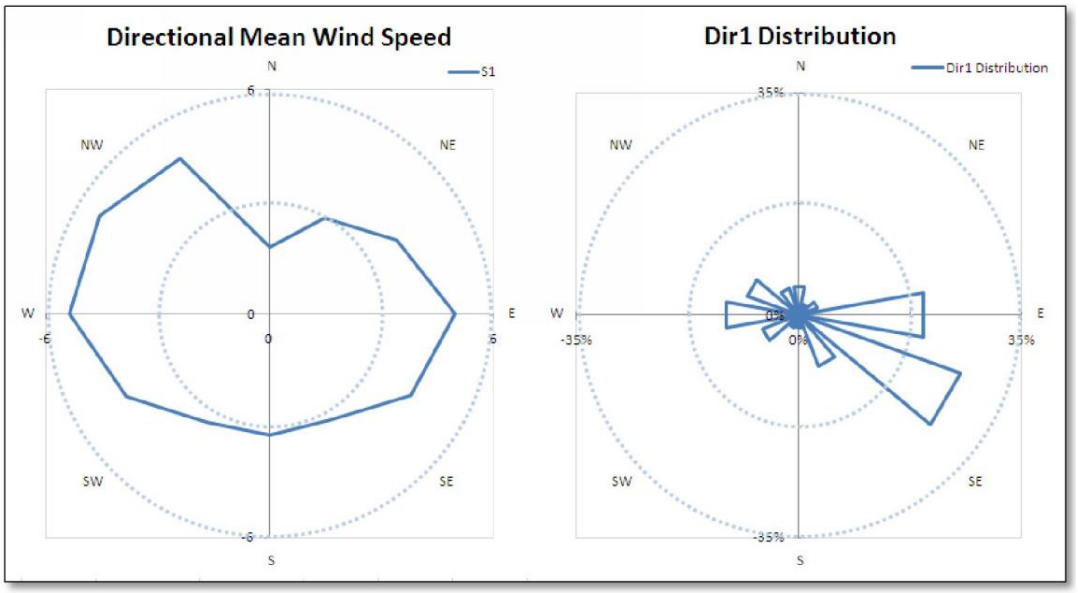

Figure 5: Glen Innes Airport wind direction distribution (long-term 2000 to 2010 monitoring)

Based on the Parsons Brinckerhoff report we note the following likelihood of wind blowing from the west:

Attribute	Monitoring Station			
	Glenroy	Nant Lodge	Rose Hill	Glen Innes Airport
Percentage of time wind blowing from western direction	18%	16%	14%	11%
Mean wind speed from western direction	8 m/s	7.5 m/s	7.8 m/s	5.4 m/s